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(54) Tubing cutting tool

(57) The tool (1) comprises a fluid powered rotary motor having a body (5) and a rotary output member (9); first fluid pressure responsive means (7) e.g. radially movable plungers for locking the body to the tubing to be cut when the pressure of the motor operating fluid exceeds a first predetermined value; a rotary cutter (10) connected to the rotary output member of the motor for rotation therewith, the rotary cutter having at least one cutting element (11) which is normally located at a first radial distance from the longitudinal axis of the tool; and second fluid pressure responsive means (16) e.g. a piston operable in response to the pressure of the motor operating fluid exceeding a second predetermined value to move the or each cutting element radially outwardly from its normal position to engage the tubing to be cut. The tool also has a cleaning or milling head (30) rotatable by the motor either with or without cutting taking place dependent upon fluid pressure level.

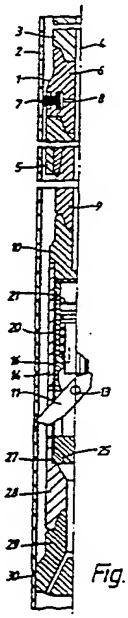

Fig. 1.

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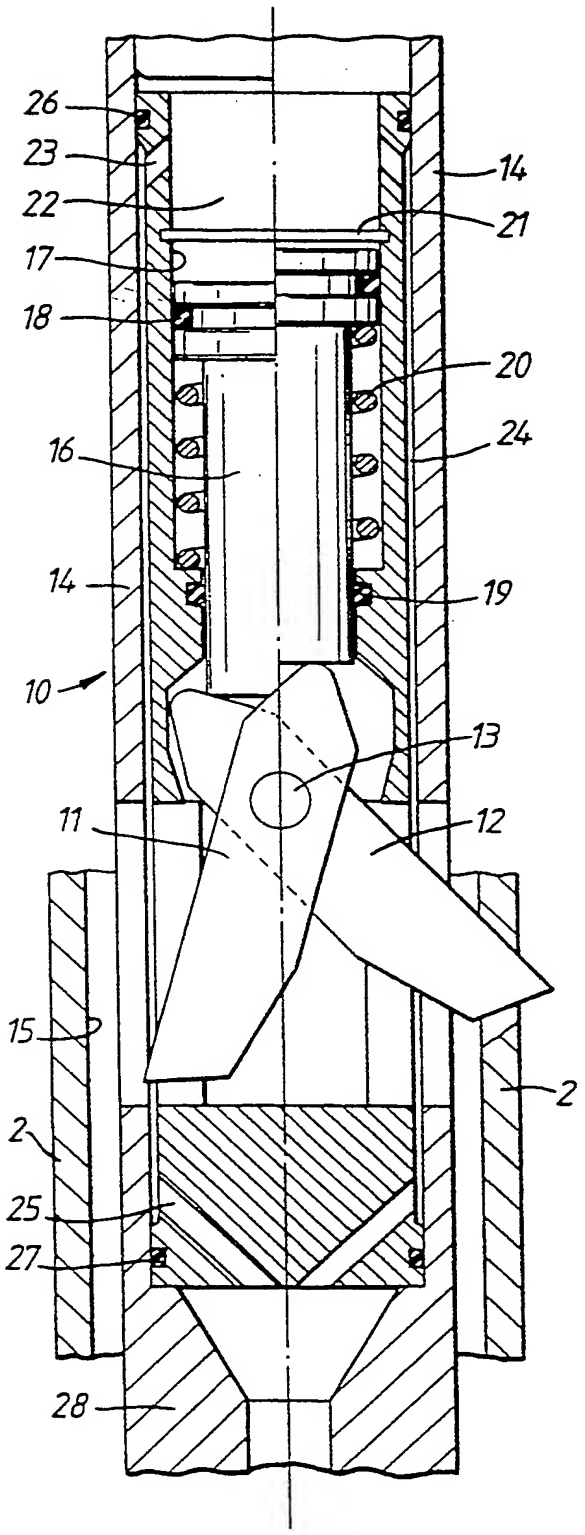
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.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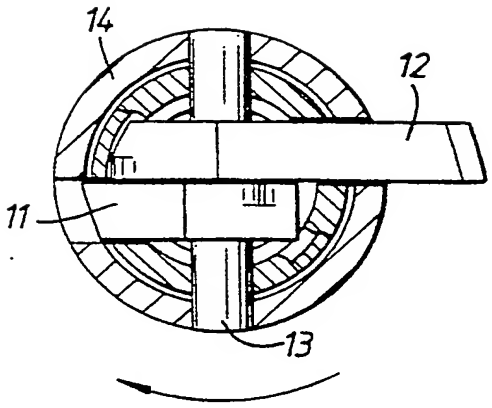
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Fig. 2.

radially outwardly from its normal position to engage the tubing to be cut.

In the preferred embodiment of the invention the fluid pressure responsive means for locking the body to the tubing is responsive to fluid pressure upstream of the rotary motor, and the fluid pressure responsive means for moving the or each cutting element is responsive to fluid pressure downstream of the rotary motor. The fluid flow path for the motor operating fluid incorporates a restriction downstream of the second fluid pressure responsive means whereby an increase in fluid flow rate results in an increase in fluid pressure at both the first fluid pressure responsive means and the second fluid pressure responsive means.

The preferred embodiment of the invention also includes a scraping or milling head which is connected to the rotary output member of the rotary motor and which may be rotated by the rotary motor for the purpose of cleaning the internal surface of the tubing within which the tool is located. In this case, the motor may be operated by fluid at a pressure less than the second predetermined pressure with the result that rotation of the motor will cause rotation of the scraping or milling tool, but will not cause the cutting elements to be moved radially outwardly into engagement with the tubing. In a particularly preferred embodiment of the invention the motor may be operated at a pressure less than the first predetermined pressure so that the scraping/milling tool may be rotated as the tool is moved through the tubing. For this purpose it is necessary to restrain the body of the motor against rotation, and this can conveniently be effected by connecting the motor body to a suitable tubing string which is used for the purpose of moving the tool through the tubing to be cleaned and for communicating operating fluid to the motor.

the motor 5 are locked against movement relative to the tubing 2.

The motor 5 includes a rotary output member 9 which is connected to a rotary cutter 10. The rotary cutter 10 is shown in more detail in Figure 2 and comprises a pair of cutting elements 11,12 which are pivotally mounted on a pin 13 which is secured to the body 14 of the rotary cutter.

The radially outer extremity of each cutting element 11,12 is suitably protected, e.g. by means of inserts or crushed particles of suitable hardening material, e.g. tungsten carbide or cubic boron nitride. In the normal position of the cutting elements (illustrated on the left-hand side of Figure 2) the cutting elements are located such that the radially outermost extremity of each cutting element is located within the body 14 of the rotary cutter. Each cutting element may, however, be pivoted to move the cutting edge thereof radially outwardly to engage the internal surface 15 of the tubing within which the tool is located. The radially outwardly extreme position of the cutting element 12 is illustrated on the right-hand side of Figure 2, and in this position the outermost point of the cutting element will have cut through the wall of the tubing 2.

For the purpose of shifting the cutter elements 11,12 between the extreme positions described above a fluid pressure responsive device is provided in the form of a piston 16 working in a cylinder 17. Seals 18,19 are provided between the piston 16 and the cylinder 17 and the piston is normally biased upwardly to the position illustrated on the right-hand half of Figure 2 by a spring 20. Further upward movement of the piston 16 is prevented by a spring clip 21 located within a groove in the cylinder wall.

radially outwardly to grip the tubing to fix the motor body relative to the tubing. The fluid pressure downstream of the motor 5 operates within the chamber 22 to bias the piston 16 downwardly and thereby move the cutters 11,12 radially outwardly to engage the internal wall of the tubing. Since the entire rotary cutter is rotating the cutting elements will cut the tubing and will be held in engagement with the tubing as cutting proceeds by the piston 16. When the cut has been completed the piston 16 will be in the extreme lower position illustrated on the left-hand side of Figure 2. Flow of operating fluid may then be stopped allowing the piston 16 to return to its uppermost position, thereby allowing the cutters 11,12 to return to their radially inner position. The plungers 7 will also return to their retracted position under the influence of the associated springs. The tool may then be moved to a fresh location for a further cutting operation, or may be used in the cleaning mode described above.

It will be appreciated that the tool described above may perform either a tube cleaning operation or a tube cutting operation, or a combination of these operations. The tool is relatively simple in construction and does not require withdrawal from the tubing for resetting after each cut has been made.

In another embodiment the cylinder 17 may be integral with the body 14 and the chambers 22 and passages 23,25 bored accordingly. Plugs would be fitted to seal the upper end of the passage 24 running the length of the body connecting passages 23 and 25.

5. A tool according to any preceding claim, wherein the first fluid pressure responsive means comprises a plurality of radially operable, spring-biased plungers.

6. A tool according to any preceding claim, wherein the second fluid pressure responsive means comprises a spring-biased piston.

7. A tool according to claim 6, wherein the piston is longitudinally operable, in response to the pressure of the motor operating fluid exceeding the second predetermined value, to pivot the or each cutting element radially outwardly from its normal position to engage the tubing to be cut.

8. A tool according to any preceding claim, further comprising a scraping or milling head connected to the rotary output member of the rotary motor and rotatable by the rotary motor for the purpose of cleaning the internal surface of the tubing within which the tool is located.

9. A tool according to claim 8, wherein the motor is operable by fluid at a pressure less than the second predetermined pressure to cause rotation of the scraping or milling head, such that rotation of the motor at this operating pressure will not cause the or each cutting element to be moved radially outwardly into engagement with the tubing.

10. A tool according to claim 8 or claim 9, wherein the motor is operable at a pressure less than the first predetermined pressure to rotate the scraping/milling head as the tool is moved through the tubing.

11. A tool substantially as hereinbefore described with reference to the accompanying drawings.

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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